RESRAD-BUILD Model Ingestion Equation, Residential Cancer Risk (1):

$$CR_{d-ing} = C_d \times SER \times (24 \times ED \times F_{in} \times F_i) \times SF_o$$

where:

$CR_{d\text{-}ing}$ = Cancer risk due to ingestion of deposited dust particulates containing radionuclide in compartment at time t over the exposure duration *(ED)* (unitless);

C_d = Surface concentration of radionuclide n deposited onto horizontal surfaces of compartment (pCi/m^2) over the exposure duration *(ED)* , starting at time t;

SER = Surface ingestion rate or the ingestion rate of dust particulates deposited onto horizontal surfaces (adult = 0.0001 m^2/h; child = 0.0002 m^2/hr);

24 = Time conversion factor (h/d);

ED = Exposure duration (adult = 7,300 days [i.e., 20 yrs]; child = 2,190 days [i.e., 6 yrs]);

F_{in} = Fraction of time spent indoors (0.96) (unitless);

F_i = Fraction of indoor time spend at compartment (unitless);

SF_o = Ingestion cancer slope factor for radionuclide n (Risk/pCi);

Notes - RESRAD-BUILD:

(1) Removable fraction of 0.2 (not shown in above equation) is assumed in HPNS model runs.

Comparison of Cancer Risk Equations for the Ingestion Pathway, RESRAD-E

BPE

where:

$CR_{d\text{-}ing}$ =

C_d =

k =

t_{res} =

λ =

F_{in} =

F_i =

SF_o =

$IFD_{res\text{-}adj}$ =

$$IFD_{res-adj} = \{[(FTSS_h \times EF_{res-c} \times ET_{res-c,h}) + (FTSS_s \times EF_{res-c} \times ET_{res-c,s})] \times [SE \times ED_{res-c} >$$
$$\{[(FTSS_h \times EF_{res-a} \times ET_{res-a,h}) + (FTSS_s \times EF_{res-a} \times ET_{res-a,s})] \times [SE \times ED_{res-a} \times SA_{re}$$

BUILD Model Versus BPRG Calculator

RG Calculator Ingestion Equation, Residential Cancer Risk (2):

$$CR_{d-ing} = \frac{C_d \times \left(\frac{1 - e^{-k \times t_{res}}}{k t_{res}}\right) \times \left(1 - e^{-\lambda t_{res}}\right) \times IFD_{res-adj} \times F_{in} \times F_i \times SF_o}{t_{res} \times \lambda}$$

Cancer risk due to ingestion of deposited dust particulates containing radionuclide in compartment at time t ove
(ED) (unitless);

Surface concentration of radionuclide n deposited onto horizontal surfaces of compartment (pCi/m^2) over the e
starting at time t;

Dissipation rate constant over total residence time, t_{res}; (set to 0 yr^{-1})

Time - resident (26 years)

Radionuclide-specific decay constant = $0.693/t_{1/2}$

where $t_{1/2}$ = half-life (yr^{-1})

Fraction of time spent indoors (1) (unitless);

Fraction of indoor time spend at compartment (1) (unitless);

Ingestion cancer slope factor for radionuclide n (Risk/pCi).

Age-adjusted Dust Ingestion Rate - Resident (528,220 cm^2)

where:

$$\langle SA_{res-c} \times FQ_c]\} +$$
$$_{s-a} \times FQ_a]\}$$

where:

$ED_{res\text{-}a}$ = Exposure duration - adult resident (20 years)

$ED_{res\text{-}c}$ = Exposure duration - child resident (6 years)

$EF_{res\text{-}a}$ = Exposure frequency - adult resident (350 days/yr)

$EF_{res\text{-}c}$ = Exposure frequency - child resident (350 days/yr)

$ET_{res\text{-}a,h}$ = Exposure time - adult resident hard surface (6 hr/day)

$ET_{res\text{-}c,h}$ = Exposure time - child resident hard surface (6 hr/day)

$ET_{res\text{-}a,s}$ = Exposure time - adult resident soft surface (10 hr/day)

$ET_{res\text{-}c,s}$ = Exposure time - child resident soft surface (10 hr/day)

FQ_a = Frequency of hand to mouth - adult (1.64 events/hr)

FQ_c = Frequency of hand to mouth - child (17 events/hr)

$FTSS_h$ = Fraction transferred surface to skin - hard surface (0.5) (unitless)

$FTSS_s$ = Fraction transferred surface to skin - soft surface (0.1) (unitless)

$SA_{res\text{-}a}$ = Surface area of fingers - adult (11.5 cm^2)

er the exposure duration

xposure duration *(ED)* ,

Notes - BPRG:

(2) In the HPNS BPRG models, a removable fraction of 20% (not shown in the above equations) was applied to EPCs for the ingestio

$SA_{res\text{-}c}$ = Surface area of fingers - child (3.7 cm^2)

SE = Saliva extraction factor (0.5) (unitless)

n pathway (i.e., the RGs).